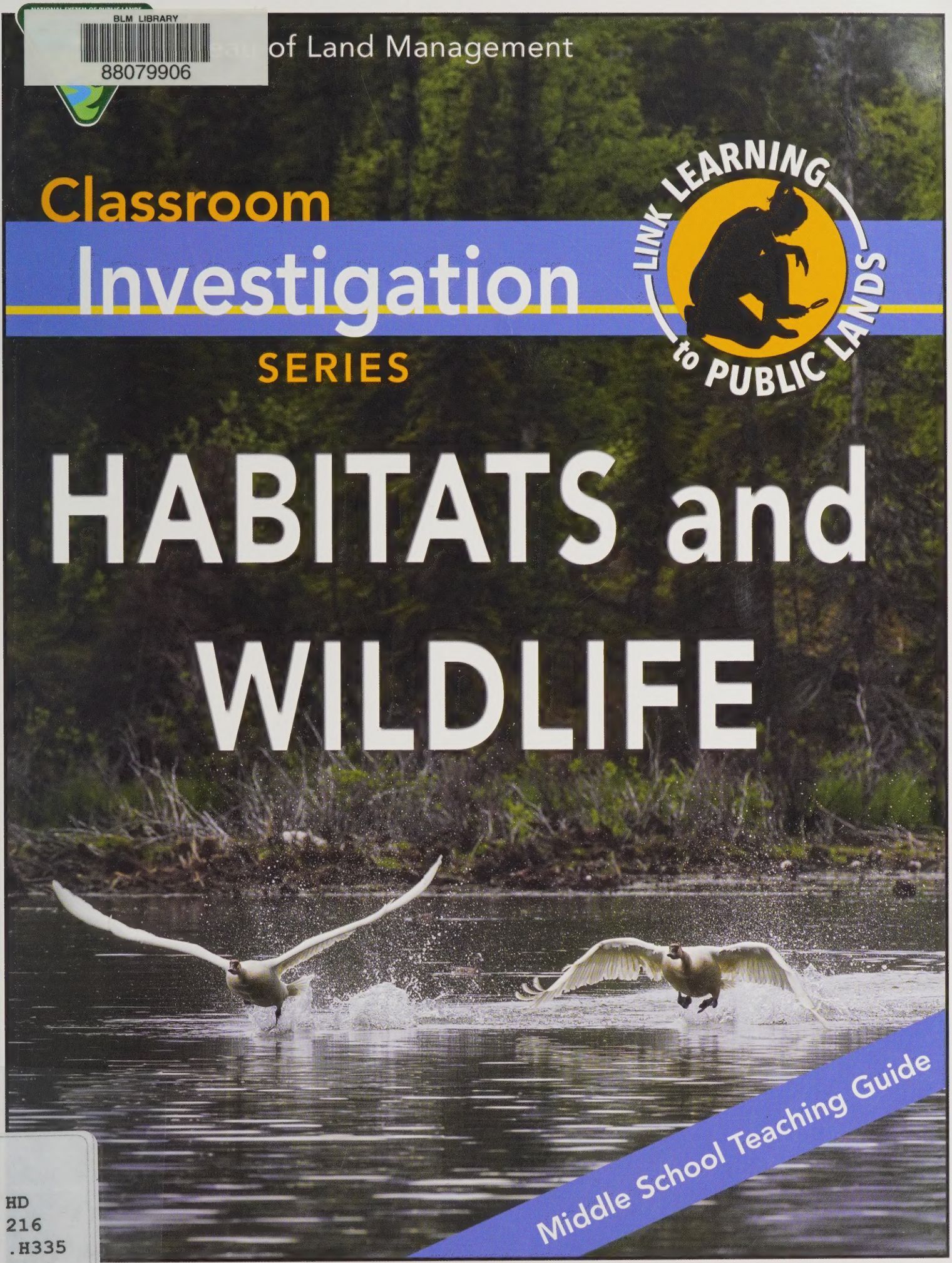
of Land Management

Classroom Investigation SERIES

LINK LEARNING to PUBLIC LANDS

HABITATS and WILDLIFE



Middle School Teaching Guide

Dear Teacher,

Welcome to this Classroom Investigation Series unit on habitats and wildlife on public lands. From its four activities, students will learn about the importance of habitat conservation, how changes to habitat health affect wildlife, and how the Bureau of Land Management (BLM) monitors and promotes healthy habitats.

The unit is designed for middle school students, but it can be adapted for the high school and upper elementary levels. The activities offer students speaking, research, and teaching roles as they progress through the unit.

The activities engage students in using diverse cognitive skills such as interpreting written material, designing an experiment, and creating slideshows to teach one another about the diverse habitats and wildlife of the Western United States.

The unit supports innovative strategies in education, such as:

Inquiry-based instruction: Students develop and address questions about habitats based on general facts about an animal, and they design an experiment that would help land managers assess the relative effectiveness of strategies to promote healthy habitats.

Social and emotional learning: Students participate in small groups in which they need to work together, develop slideshows to present content to other students, listen and speak to one another, and collaborate.

Interdisciplinary instruction: While the unit focuses on facts about habitats and wildlife, it also addresses key concepts in social studies and English language arts. For social studies, students examine how a federal agency works with other agencies and the public to monitor habitats; for English language arts, they use evidence to interpret documents about wildlife and synthesize facts into a slideshow about habitats.

Each activity in the unit takes one or two 45-minute class periods; the entire unit takes six 45-minute periods. The activities work best as a collective unit that progresses from designing habitats and describing habitat monitoring to assessing habitat change and designing an experiment on methods of promoting healthy habitats.

Curriculum Connections

In its entirety, the unit aligns with Next Generation Science Standard MS-LS2-1: "Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem."

The activities address the following essential understandings:

- A healthy habitat is an area that has enough food, water, shelter, and living space for an animal to survive and reproduce. An area that meets the food, water, shelter, and space needs for a wildlife species defines the habitat of that species.
- Habitat changes can threaten or benefit species, causing them to move, adapt, or perish or to flourish and thrive.
- The BLM's roles on public lands include monitoring, preserving, and enhancing, where needed, the health of habitats to protect and enhance fish and wildlife populations.

Front Cover: Alaska wildlife. Photo by Bob Wick

About the Bureau of Land Management

The BLM cares for about 245 million acres of federally owned public lands, mainly in the Western United States and Alaska. These lands, representing about one-eighth of our nation's land area, belong to all Americans. In addition, the BLM administers 700 million acres of mineral estate across the entire country.

Public lands are used for many purposes. They support local economies, providing Americans with coal, oil and gas, forest products, livestock forage, and other commodities. As a haven for fish and wildlife, they play a critical role in habitat and resource conservation efforts. They embrace some of our country's most important historical, archaeological, and paleontological sites. Open spaces on public lands offer places for people to play, learn, and explore. In recent years, some BLM lands have been designated as part of the National Conservation Lands, a network of lands afforded special status and managed almost exclusively to conserve their scientific, cultural, educational, ecological, and other values.

The BLM is responsible for managing public lands under the principles of multiple use and sustained yield in a manner that best meets the current and future needs of the public. With so many resources and uses, the BLM's job is challenging. Thankfully, countless partners, volunteers, and communities provide invaluable support, helping the agency carry out its stewardship mission. To learn more about your public lands and how you can get involved, visit *http://www.blm.gov.*

Landscapes, Habitats, and Wildlife

All living things depend on healthy habitats for food, water, shelter, and space. Imperiled habitat—its loss, degradation, or fragmentation—is the main cause of decline among wildlife populations in the Western United States and across the globe. Some wildlife species rely on vast expanses of land to accommodate migration, so human activity that fragments habitat affects these animals in particular. Other creatures require just a few acres of space, so degradation may be the main concern. And when habitats are destroyed, wildlife species adapt, move, or perish.

Habitats come in a wide variety of sizes and scales, from a few acres to thousands of square miles. Efforts to protect habitats are usually most effective when undertaken at a landscape level. Landscapes are large, connected geographical regions that have similar environmental characteristics. Managing at the landscape level provides more of a panoramic view as opposed to a snapshot.

A mix of nearby and distant events can affect local wildlife habitat conditions. A local approach to habitat conservation might address nearby challenges and overlook more distant occurrences, such as when reduced snowpack hundreds of miles upstream impairs water quality and ecosystem health near a delta. The landscape approach offers land managers enhanced information as they make decisions about appropriate uses of the land, from recreation and cultural preservation to oil drilling and solar energy permitting. Landscape-level analysis can help managers weigh tradeoffs and broad consequences as they work with communities; local, state, federal, and tribal government agencies; interest groups; and businesses to make land use decisions.

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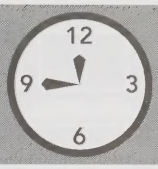
Activity 1: Illustrate Habitat Essentials

Time Estimate

45 minutes



Learning Objectives

Students will be able to (1) define "habitats," (2) list the four main benefits provided by habitats, and (3) describe the various types of habitats in the Western United States and their diverse scales.

For the Teacher

This activity addresses the following essential understanding:

- A healthy habitat is an area that has enough food, water, shelter, and living space for an animal to survive and reproduce. An area that meets the food, water, shelter, and space needs for a wildlife species defines the habitat of that species.

Overview

In this activity, students define "habitats" by examining the needs of an animal and designing a habitat that satisfies those needs.

This is the first of four activities that introduce students to habitats and wildlife on public lands.

Teacher Preparation

1. Read the "Background Information."
2. Make enough copies of the animal factsheets so that each student in each of the five groups has a factsheet about his or her group's animal.
3. Make as many copies of the "Note-Taking Guide" as needed for all students.
4. Provide enough flipchart paper and markers for five student groups.

Background Information

The term "habitat" refers to the place where an organism lives. For an animal, this place must contain resources necessary to sustain a viable self-reproducing population: food, water, space, and shelter. There are many different types of habitats, from forests to grasslands to oceans and even cities. Different habitats support different communities of plants and animals.

Habitats are constantly changing. Sometimes natural occurrences such as droughts, diseases, fires, hurricanes, mudslides, volcanoes, and earthquakes can cause abrupt changes. Other natural changes may be less drastic, such as slight increases or decreases in seasonal temperature or precipitation and the natural succession of plant communities. Many plants and animals can adapt to or evolve with habitat changes that occur slowly over hundreds, thousands, or millions of years.

Procedure

1. **Introduce habitat elements:** Discuss how habitats provide food, water, shelter, and space for wildlife.
2. **Form groups:** Divide the class into five groups, in which students will design and illustrate a habitat for an animal. Assign each group to one of the animals featured on the factsheets (one to the pronghorn, one to the desert tortoise, and so forth). Distribute the animal factsheets, flipchart paper, and markers to the appropriate groups and review the directions on the factsheets.
3. **Design habitats:** Let students know they will have 15 minutes to design and illustrate a habitat for their animal and to select one or more group members to explain the habitat to the rest of the class.
4. **Present habitat illustrations and share suggestions:** Ask the presenters from each group to describe the group's habitat and display their habitat illustration. Encourage everyone else in the class to write down questions and suggestions for the presenters, using the "Note-Taking Guide" as needed. After each presentation, invite students to ask their questions or share their suggestions. Record suggestions on the board and encourage students to consider incorporating those that are useful and relevant.
5. **Summarize the habitat discussion:** Conclude the class by asking students how the groups' habitats illustrate:
   - what habitat means
   - the features provided by habitats that allow wildlife to survive
   - the similarities and differences among the habitats, including the diverse types and scales

Note: Save the habitat illustrations created by the students for use in activities later in the unit.

Assessment

The students' illustrations should indicate how well they understand habitat based on a general description of an animal. Their questions and suggestions should illustrate how well they understand habitat features.

Adaptations to Consider

Substitute local wildlife for any of the five animals provided.

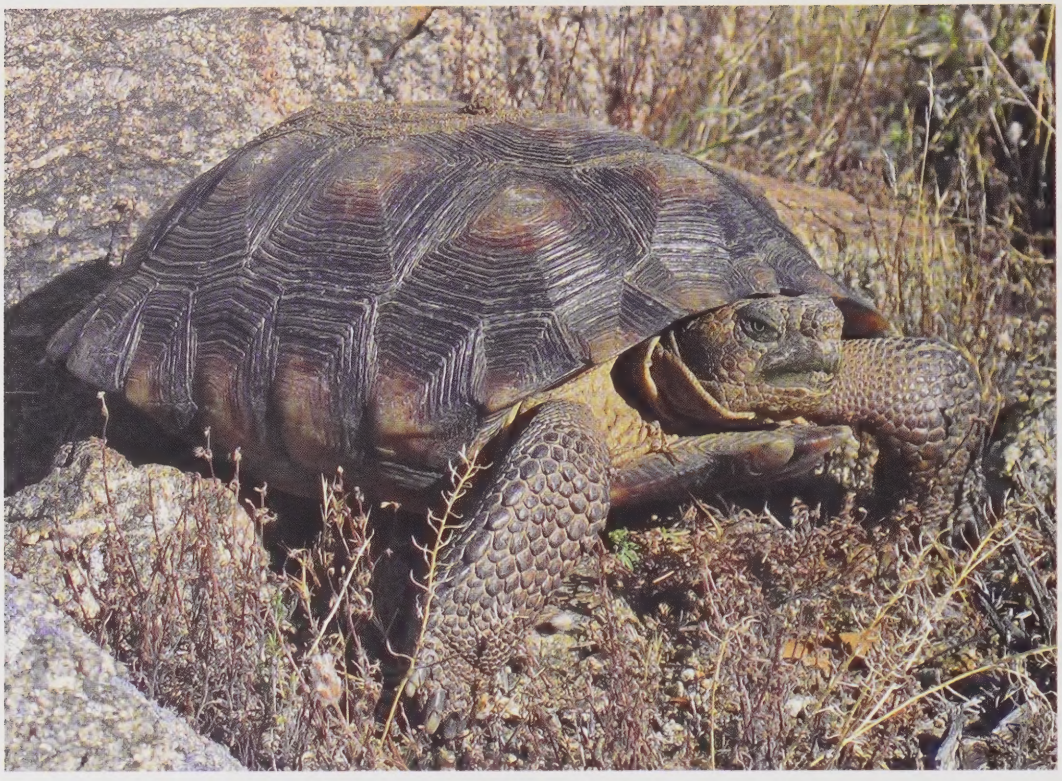
Give students a writing assignment that asks them to describe their own habitat, addressing their space, shelter, food, and water needs. If students struggle with the concept of habitat scales, ask them to nest their habitat features in terms of home, neighborhood, city or county, state, and region.

In the Field

Have students select a plot of land, either on school grounds or nearby, and identify and illustrate the wildlife and habitats found there. They may observe the land over a number of months to illustrate continuity and change.

Factsheets

Desert Tortoise *(Gopherus agassizii)*



U.S. Fish and Wildlife Service

Directions: Read the information below about the desert tortoise. Work with the other students in your group to design a habitat for the animal, and draw the habitat on flipchart paper. Choose one or more presenters to share information on your habitat with everyone else in the class. Be prepared to answer questions and listen to suggestions from other students after your presentation.

The desert tortoise spends up to 95 percent of its life underground. It lives in sandy flats, rocky foothills, and canyons where it can find the right kind of soils to construct a den.

Tortoises depend on bushes for shade and protection from predators such as ravens and coyotes. During spring and summer, tortoise burrows vary from 18 inches to 5 feet long but may only be a few inches below the surface. Winter burrows tend to be about 8 feet long and may be 2 to 3 feet below the surface. A young desert tortoise will usually stay within 150 feet of its burrow. As it gets older, it may go as far as 3/4 mile in a day using a network of burrows.

The tortoises' diet consists primarily of wildflowers, grasses, and cacti. During periods of sufficient rainfall, tortoises drink from temporary rain pools. In years with low rainfall, females may lay few or no eggs.

This information is from *http://www.fws.gov/nevada/desert_tortoise/dt/dt_life.html.* Additional information is available on the website.

Marbled Murrelet *(Brachyramphus marmoratus)*

U.S. Fish and Wildlife Service

Directions: Read the information below about the marbled murrelet. Work with the other students in your group to design a habitat for the animal, and draw the habitat on flipchart paper. Choose one or more presenters to share information on your habitat with everyone else in the class. Be prepared to answer questions and listen to suggestions from other students after your presentation.

The marbled murrelet is a small, diving sea bird that spends almost all of its time on the ocean resting and feeding. It flies inland to nest.

Marbled murrelets nest in forests where there are large trees with large branches or deformities that they can use as nest platforms. These forests range in size from several acres to thousands of acres. Nesting forests primarily consist of mixed conifer trees in Oregon and Washington and old-growth redwoods in California.

When they are on the ocean, marbled murrelets usually stay within 5 miles of shore and in water less than 200 feet deep. Their main prey includes small schooling fish such as the northern anchovy, immature Pacific herring, and Pacific sardine.

This information is from *http://www.nps.gov/redw/naturescience/marbled-murrelet.htm* and *http://www.fws.gov/wafwo/species/Fact%20sheets/Factsheet%20MAMU.pdf*. Additional details are available on these websites.

Pronghorn *(Antilocapra americana)*

U.S. Fish and Wildlife Service

Directions: Read the information below about the pronghorn. Work with the other students in your group to design a habitat for the animal, and draw the habitat on flipchart paper. Choose one or more presenters to share information on your habitat with everyone else in the class. Be prepared to answer questions and listen to suggestions from other students after your presentation.

Pronghorns are wild grazing animals unique to North America. Though people sometimes call them pronghorn antelope, they are not related to the antelopes of Africa and Asia. Pronghorns live across the West in open plains, grasslands, and deserts. They eat prairie plants such as sagebrush, grasses, and forbs (green, leafy plants that are not grasses). The plants provide nearly all the water the pronghorns need.

The pronghorn is a plains animal that favors wide-open spaces. As winter approaches, pronghorn populations in the coldest areas travel 150 miles south to get away from deep snow, which buries the prairie plants they eat. Once spring arrives, these pronghorn make the 150-mile return trip north.

With an ability to run nearly 60 miles per hour, pronghorns may be the fastest land mammal in North America, but they will not jump over anything more than 3 feet high.

This information is from *http://www.nwf.org/wildlife/wildlife-library/mammals/pronghorn.aspx.* Additional details are available on the website.

Greater Sage-Grouse *(Centrocercus urophasianus)*

Directions: Read the information below about the greater sage-grouse. Work with the other students in your group to design a habitat for the animal, and draw the habitat on flipchart paper. Choose one or more presenters to share information on your habitat with everyone else in the class. Be prepared to answer questions and listen to suggestions from other students after your presentation.

Greater sage-grouse stand up to 2 feet tall and weigh between 2 and 7 pounds. As their name suggests, greater sage-grouse live in sagebrush steppe habitats that include grasses, forbs (other green leafy plants), and shrubs. In cold months, the birds shelter under mature sagebrush. In spring, males and females congregate on leks—large, open flat areas surrounded by sagebrush—to breed. Individual birds often use the same lek year after year.

After mating, hens fly 4-15 miles from the lek to nest and rear their broods. Hens nest within the same 2 or 3 square yards every year. They gradually move to moist areas such as streambanks and wet meadows during the brood-rearing phase to feed on the forbs and insects needed to ensure chick survival. When greater sage-grouse return to find that a lek or nesting area has been disturbed, they have difficulty adapting to the changes or finding substitute habitat.

This information is from *http://www.blm.gov/wo/st/en/prog/more/sagegrouse/conservation.html*. Additional details are available on the website.

Vernal Pool Fairy Shrimp *(Branchinecta lynchi)*

U.S. Fish and Wildlife Service
Dwight Harvey

Directions: Read the information below about the vernal pool fairy shrimp. Work with the other students in your group to design a habitat for the animal, and draw the habitat on flipchart paper. Choose one or more presenters to share information on your habitat with everyone else in the class. Be prepared to answer questions and listen to suggestions from other students after your presentation.

Vernal pools are wetlands that fill with water during fall and winter rains and dry up during spring and summer. They can be as small as a puddle or as large as a lake.

Vernal pool fairy shrimp are translucent, slender crustaceans (relatives of lobsters, crabs, saltwater shrimp, and barnacles) that live only in parts of California and Oregon. They are generally less than 1 inch in length, and they swim on their backs by slowly moving their 11 pairs of swimming legs. They are unusual in that they use these same legs for breathing and feeding. They eat algae and plankton by scraping and straining them from surfaces within the vernal pool. Fairy shrimp are defenseless and therefore occupy temporary ponds where aquatic predators cannot survive.

Vernal pool fairy shrimp hatch when the first rains of the year fill vernal pools. Adult fairy shrimp live only for a single season, while there is water in the pools. Toward the end of their brief lifetime, females produce thick-shelled "resting eggs" also known as cysts. During the summer, these cysts embed in the dried bottom mud, and during the winter, they freeze for varying periods. These cysts hatch when the rains come again.

This information is from *http://www.fws.gov/oregonfwo/species/data/vernalpoolfairyshrimp/*. Additional details are available on the website.

Note-Taking Guide

Animal:	Brief description of habitat:

Food source(s):

Questions or comments about food:

Water source(s):

Questions or comments about water:

Space:

Questions or comments about space:

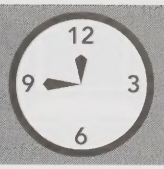
Shelter:

Questions or comments about shelter:

Activity 2: Monitor Habitat Health

Time Estimate

45 minutes



For the Teacher

This activity addresses the following essential understanding:

- The BLM's roles on public lands include monitoring, preserving, and enhancing, where needed, the health of habitats to protect and enhance fish and wildlife populations.

Learning Objectives

Students will be able to (1) describe a strategy for monitoring habitat health, and (2) explain the relationship between monitoring and improving habitat health.

Overview

In this activity, students explore how the BLM and other land management agencies monitor the health of habitats.

This is the second of four activities that introduce students to habitats and wildlife on public lands.

Teacher Preparation

1. Read the "Background Information."
2. Provide the habitat flipchart papers that students created in activity 1.

Background Information

Scientists use a variety of tools and methods to understand habitat health and change. They rely on both simple tools and advanced technology. The tools vary based on the size of the habitat, the purpose for monitoring, and other factors.

Studying large, landscape-scale habitats involves collecting data at different scales. Scientists often use images of the land taken by satellites hundreds of miles above the Earth, sometimes over an extended period. This satellite imagery, together with on-the-ground assessments, provides an accurate picture of what's happening and how conditions may have changed over time.

Satellite images reveal important characteristics of the land, such as the location, degree of slope, precipitation, elevation, and amount of surface water. They can also show the different plants and shrubs that grow in a given place. Some satellites can zoom in on areas as small as 3 square yards, so scientists can actually pick out individual shrubs and identify them.

Satellite imagery can only reveal so much. It cannot always help identify all species of plants or determine the species of wildlife that inhabit an area. For that, a closer look is required. Scientists use a variety of tools for on-the-ground monitoring. Here are descriptions of some of them:

Transects and plots: It might be impossible to count all of the plants, insects, or other wildlife in a study area because of the immense number of species or the large size of the area; therefore, scientists use transects and plots.

A transect is a line along which certain measurements are taken. A plot is an area marked by a tape, line, or fence. After using a global positioning system (GPS) to identify an exact location, scientists can count and study the plants and animals along a transect or within a plot. These plants and animals represent a sample of what is living in the larger area. Using transects and plots, scientists can count animals and measure vegetation canopy (the layer formed by the leafy crowns of plants aboveground), ground cover (low-growing plants or shrubs), and other habitat details, noting changes over time.

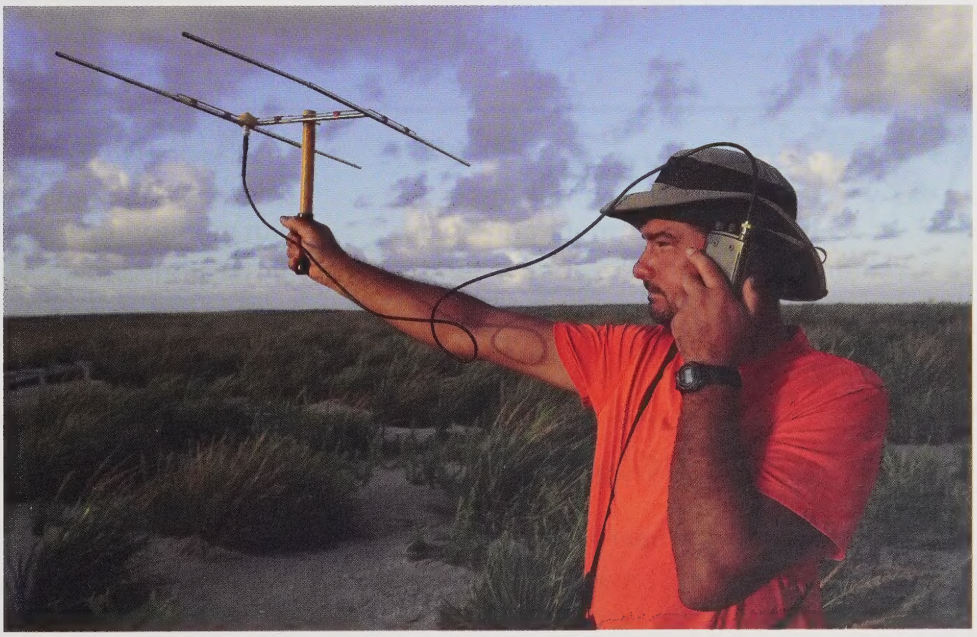
Radio telemetry: Scientists use radio telemetry to help track and find a wide variety of animals—from wolves to ducks to fish—in the wild. They must first catch the animals to be tracked. They then either attach a radio transmitter to a collar placed around the animal's neck or implant a small transmitter in or on the animal.

The transmitter emits a beeping signal. A receiver and directional antenna pick up the signal, providing location data. Scientists then plot this data on a map to illustrate an animal's range and learn about its movements and behaviors.

Densiometer: This device measures canopy cover, or density, of vegetation. By looking up through a densiometer, researchers can determine the approximate percentage of sky blocked by vegetation. Canopy cover frequently is measured in association with a survey (examination and documentation) of ground cover.

Bionic ear: This device magnifies sounds and is useful for observing and studying wildlife. The "ear" can be pointed in certain directions to pick up animal sounds that otherwise would be too faint to hear. The bionic ear is especially useful in helping scientists determine all the species living in a habitat, including those that are active only at night.

Monitoring data can prompt land managers to change habitat management practices over time. For example, the data may show that always putting out wildfires is not the best practice for habitat health. Wildfire may reduce or eliminate weeds and invasive species and allow native plants that the wildlife depend upon to reestablish.



U.S. Fish and Wildlife Service

Procedure

1. **Introduce habitat health:** Have students brainstorm answers to the question, "What are the characteristics of a healthy habitat for your animal from activity 1?" Write their responses on the board.
2. **Form groups:** Assign students to the same animal groups as in activity 1, and ask them to describe how they would monitor the health of their group's habitat:
   - What would they monitor?
   - What tools/technologies would they use?
   - How often would they collect data?
   - How would they present the data?
3. **Develop monitoring plans:** Give students 10 minutes to add a monitoring plan to their habitat illustrations from activity 1. (Provide each group an additional sheet of flipchart paper if needed.) Have students select one or more presenters to share their monitoring ideas with the rest of the class.
4. **Present monitoring plans and share suggestions:** Ask the presenters from each group to describe their monitoring plans. Encourage everyone else in the class to write down questions and suggestions for the presenters. After each presentation, invite students to ask their questions or share their suggestions. Record suggestions on the board and encourage students to consider incorporating those that are useful and relevant.
5. **Summarize the monitoring discussion:** Conclude the class with a discussion of how:
   - monitoring plans are alike and different based on habitat size, setting, and animal
   - the data they need to collect and the technology they would use are related
   - suggestions from other students affected their ideas about what to monitor
   - scientists' views on monitoring and habitat health have changed over time based on results, new technologies, and observations over longer periods (for example, changing views about suppressing wildfires)

Assessment

The students' monitoring plans should indicate how well they understand the purposes of and methods associated with monitoring. Their questions and suggestions should illustrate how well they understand monitoring.

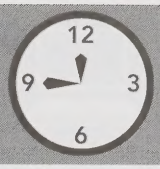
In the Field

Have students select a nearby plot of land where they can set up a transect to identify the plants and other habitat features there.

Activity 3: Initiate a Habitat Internet Investigation

Time Estimate

90 minutes



Learning Objectives

Students will be able to (1) describe how their animal's habitat is threatened, and (2) explain the relationship between the health of their animal's habitat and its population.

For the Teacher

This activity addresses the following essential understandings:

- Habitat changes can threaten or benefit species, causing them to move, adapt, or perish or to flourish and thrive.
- The BLM's roles on public lands include monitoring, preserving, and enhancing, where needed, the health of habitats to protect and enhance fish and wildlife populations.

Overview

In this activity, students examine in detail how habitat changes affect their animal. They develop a slide show, using PowerPoint or similar software, with information about the animal, habitat changes, and population trends.

This is the third of four activities that introduce students to habitats and wildlife on public lands.

Teacher Preparation

1. Read the "Background Information."
2. Make enough copies of the "Internet Investigation Worksheet" for each student; there is a unique version of the worksheet for each animal.
3. Provide at least one computer or tablet with Internet access and PowerPoint (or similar) software to each of the five groups.

Background Information

People initiate a variety of activities, including urbanization, agricultural development, manufacturing, recreation, and transportation, that can result in habitat changes. Some activities, such as building a new shopping center in a forested area or building a road through a meadow, result in obvious changes to habitat. Other activities, such as moving a herd of cattle to a new area on the rangeland or inadvertently introducing invasive plant seeds, result in more subtle changes to habitat. The effects on the land from such changes develop over many years. Road corridors can provide access for invasive plants, for instance, and power lines can provide perch sites for predators such as common ravens or raptors.

As human populations have grown and expanded into lands that once were wild, there has been an increased demand for resources from these lands. Changes associated with urban expansion and development of rural areas directly influence the number and kinds of plants and animals that remain. Scientists study natural and human-caused habitat changes over time to understand the associated effects on plants and animals. Once scientists understand these effects, they can recommend actions to prevent or minimize them.

Procedure

1. **Introduce habitat research:** Explain that students will be consulting some websites to learn more about their animal and its habitat, after which they will create and present a slide show.
2. **Form groups:** Assign students to the same animal groups as in the previous activities. Distribute the appropriate "Internet Investigation Worksheet" to each group. Review the directions and have all groups select one or more presenters.
3. **Create slide shows:** Circulate among the groups and provide assistance as necessary. Students should complete at least a draft of their slide show by the end of the first 45-minute period.
4. **Present slide shows:** During the second 45-minute period, have students share their slide shows. Ask the presenters from each group to describe their animal and its habitat. Encourage everyone else in the class to write down questions and suggestions for the presenters. After each presentation, invite students to ask their questions or share their suggestions. Record suggestions on the board and encourage students to consider incorporating those that are useful and relevant.
5. **Summarize the habitat change discussion:** Conclude the class by asking students about:
   - the animal's population trend and how it relates to habitat health
   - the threats facing each animal and what threats the animals have in common

Assessment

The slide shows should include information addressing items 1-8 on the worksheet. When describing their animal's population trend, the students should use the available information to speculate about why the population has changed.

Adaptations to Consider

Use local wildlife and habitats as substitutes for any of the animals in this activity, and provide links to websites for the substituted animals that address items 1-8 on the worksheet.

Add time before step 4 to allow students to practice their presentations within their groups before they present to the entire class.

Internet Investigation Worksheet for Desert Tortoise

Directions: Use the websites below to find and record answers to questions 1-8. Then create a PowerPoint slide show about your animal and its habitat.

1. Where is your animal's habitat (what states or areas within a state)?
2. What are the space needs of your animal (include migration if your animal migrates)?
3. How would you describe the size and scale of its habitat, and why?
4. What type of habitat does it live in? Check all types of habitat used by your animal:

____desert	____coastal
____sagebrush steppe	____riparian (adjacent to rivers or streams)
____forest	____grassland
____ocean	____vernal pool

5. What does the habitat provide for your animal in terms of:

   Food – where and how does your animal get food?

   Water – where and how does your animal get water?

   Shelter – what does your animal use for shelter?

   Space – how much habitat area does your animal need to get food, water, and shelter?

6. What are your population numbers over time? Use a graph to show this, with time in years on the X axis and population numbers on the Y axis. What do you think caused the changes in population numbers, and what evidence is there to support your idea?
7. What are the 2-3 greatest threats to your animal's habitat today?
8. Which of these threats have had the greatest effect on your animal?

Websites:

http://www.fws.gov/nevada/desert_tortoise/dt/dt_life.html

http://explorer.natureserve.org/servlet/NatureServe (enter "desert tortoise" in the search box and look under "conservation status")

Internet Investigation Worksheet for Marbled Murrelet

Directions: Use the websites below to find and record answers to questions 1-8. Then create a PowerPoint slide show about your animal and its habitat.

1. Where is your animal's habitat (what states or areas within a state)?
2. What are the space needs of your animal (include migration if your animal migrates)?
3. How would you describe the size and scale of its habitat, and why?
4. What type of habitat does it live in? Check all types of habitat used by your animal:

   ____desert ____coastal

   ____sagebrush steppe ____riparian (adjacent to rivers or streams)

   ____forest ____grassland

   ____ocean ____vernal pool

5. What does the habitat provide for your animal in terms of:

   Food – where and how does your animal get food?

   Water – where and how does your animal get water?

   Shelter – what does your animal use for shelter?

   Space – how much habitat area does your animal need to get food, water, and shelter?

6. What are your population numbers over time? Use a graph to show this, with time in years on the X axis and population numbers on the Y axis. What do you think caused the changes in population numbers, and what evidence is there to support your idea?
7. What are the 2-3 greatest threats to your animal's habitat today?
8. Which of these threats have had the greatest effect on your animal?

Websites:

http://www.fws.gov/oregonfwo/Species/Data/MarbledMurrelet/default.asp

http://explorer.natureserve.org/servlet/NatureServe (enter "marbled murrelet" in the search box and look under "conservation status")

Internet Investigation Worksheet for Pronghorn

Directions: Use the websites below to find and record answers to questions 1-8. Then create a PowerPoint slide show about your animal and its habitat.

1. Where is your animal's habitat (what states or areas within a state)?
2. What are the space needs of your animal (include migration if your animal migrates)?
3. How would you describe the size and scale of its habitat, and why?
4. What type of habitat does it live in? Check all types of habitat used by your animal:

____desert	____coastal
____sagebrush steppe	____riparian (adjacent to rivers or streams)
____forest	____grassland
____ocean	____vernal pool

5. What does the habitat provide for your animal in terms of:

   Food – where and how does your animal get food?

   Water – where and how does your animal get water?

   Shelter – what does your animal use for shelter?

   Space – how much habitat area does your animal need to get food, water, and shelter?

6. What are your population numbers over time? Use a graph to show this, with time in years on the X axis and population numbers on the Y axis. What do you think caused the changes in population numbers, and what evidence is there to support your idea?
7. What are the 2-3 greatest threats to your animal's habitat today?
8. Which of these threats have had the greatest effect on your animal?

Websites:

http://www.greateryellowstonescience.org/download_product/573/0

http://www.wcsnorthamerica.org/tabid/4368/default.aspx#.VEZC-_kRDuS

Internet Investigation Worksheet for Greater Sage-Grouse

Directions: Use the websites below to find and record answers to questions 1-8. Then create a PowerPoint slide show about your animal and its habitat.

1. Where is your animal's habitat (what states or areas within a state)?
2. What are the space needs of your animal (include migration if your animal migrates)?
3. How would you describe the size and scale of its habitat, and why?
4. What type of habitat does it live in? Check all types of habitat used by your animal:

____desert	____coastal
____sagebrush steppe	____riparian (adjacent to rivers or streams)
____forest	____grassland
____ocean	____vernal pool

5. What does the habitat provide for the wildlife in terms of:

   Food – where and how does your animal get food?

   Water – where and how does your animal get water?

   Shelter – what does your animal use for shelter?

   Space – how much habitat area does your animal need to get food, water, and shelter?

6. What are your population numbers over time? Use a graph to show this, with time in years on the X axis and population numbers on the Y axis. What do you think caused the changes in population numbers, and what evidence is there to support your idea?
7. What are the 2-3 greatest threats to your animal's habitat today?
8. Which of these threats have had the greatest effect on your animal?

Websites:

http://www.blm.gov/wo/st/en/prog/more/sagegrouse/conservation.html

http://www.sagegrouseinitiative.com/sagebrush-community/the-habitat/

Internet Investigation Worksheet for Vernal Pool Fairy Shrimp

Directions: Use the websites below to find and record answers to questions 1-8. Then create a PowerPoint slide show about your animal and its habitat.

1. Where is your animal's habitat (what states or areas within a state)?
2. What are the space needs of your animal (include migration if your animal migrates)?
3. How would you describe the size and scale of its habitat, and why?
4. What type of habitat does it live in? Check all types of habitat used by your animal:

   ____desert ____coastal

   ____sagebrush steppe ____riparian (adjacent to rivers or streams)

   ____forest ____grassland

   ____ocean ____vernal pool

5. What does the habitat provide for your animal in terms of:

   Food – where and how does your animal get food?

   Water – where and how does your animal get water?

   Shelter – what does your animal use for shelter?

   Space – how much habitat area does your animal need to get food, water, and shelter?

6. What are your population numbers over time? Use a graph to show this, with time in years on the X axis and population numbers on the Y axis. What do you think caused the changes in population numbers, and what evidence is there to support your idea?
7. What are the 2-3 greatest threats to your animal's habitat today?
8. What effect are these threats having on your animal?

Websites:

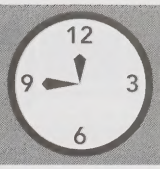
https://courses.cit.cornell.edu/icb344/abstracts/vernal-pool-fairy-shrimp.htm

http://explorer.natureserve.org/servlet/NatureServe (enter "vernal pool fairy shrimp" in the search box, and look under "conservation status")

Activity 4: Design a Habitat Experiment

Time Estimate

90 minutes



Learning Objectives

Students will be able to (1) identify the components of a proposed experiment about habitat, (2) develop hypotheses and predictions concerning habitat conservation efforts and the health of wildlife, and (3) explain how to monitor habitat health to test hypotheses.

For the Teacher

This activity addresses the following essential understandings:

- Habitat changes can threaten or benefit species, causing them to move, adapt, or perish or to flourish and thrive.
- The BLM's roles on public lands include monitoring, preserving, and enhancing, where needed, the health of habitats to protect and enhance fish and wildlife populations.

Overview

In this activity, students design an experiment based on what they learned in activities 1-3 about habitats and wildlife. Experiment designs will include a hypothesis (a proposed explanation of what threatens a habitat), a suggested action to address that threat, a prediction of the results, independent and dependent variables, a control, and a plan for data collection.

This is the fourth of four activities that introduce students to habitats and wildlife on public lands.

Teacher Preparation

1. Read the "Background Information."
2. Make enough copies of the "Experiment Design Worksheet" for each student.

Background Information

Land use managers often have a variety of actions they can take to try to reverse declines in wildlife populations. It can be challenging for them to conduct a real-world test to determine which action might be most effective, particularly if time is limited. Land managers often use a scientific approach to choose among possible actions and monitor habitat conditions to gather data about effectiveness of those actions.

Procedure

1. **Introduce habitat experiments:** Explain that students will be designing (but not conducting) an experiment based on the information they have gathered from activities 1-3.
2. **Form groups:** Divide students into the same five animal groups as in the previous activities. Distribute the "Experiment Design Worksheet," and ask the students to complete the worksheet after explaining these steps. Students should:
    - Select a hypothesized threat to their animal's habitat (example: the invasive plant tamarisk is crowding out the native plants that the animal eats).
    - Propose an action that land managers could take to stabilize their animal's population (example: remove tamarisk from the habitat).
    - Identify the independent variable (their action) that may cause a change in a dependent variable, namely, the condition of their animal's habitat (example: once we have removed tamarisk, there will be enough native plants for the animals to eat).
    - Predict the quantifiable effect they expect their action to have based on a specific amount of the action (example: physically uproot and remove 50 percent of the tamarisk in our plot to increase the food supply of native plants by 25 percent).
    - Describe a control condition to let them compare the effect of their action to the effect of taking no action. (Define the term "experimental condition" as the environment where the action is taken and the term "control condition" as an environment that is as similar as possible but where no action is taken.)
    - Describe a data-gathering plan that would give them the data needed to judge the effectiveness of their action (example: monitor the amount of tamarisk, the amount of native plants, and the population of their animal).

    Ask each of the five groups to select one or more presenters.
3. **Develop experiment designs:** Circulate among the groups and provide assistance as necessary. Students should complete at least a draft of their experiment design by the end of the first 45-minute period.
4. **Present experiment designs:** Ask the presenters from each group to describe

the group's experiment design. After each presentation, invite students to ask questions or share suggestions. Record suggestions on the board and encourage students to consider incorporating those that are useful and relevant.

5. **Summarize the experiment design discussion:** Ask students to describe what was challenging about designing the experiment, what they would change if they were going to design the experiment again, and what they and land managers would learn if they had the following results:

   - Result 1: the population stabilized in the experimental condition, and the population continued to decline as before in the control condition.
   - Result 2: the population continued to decline as before in the experimental condition, while the population stabilized in the control condition.
   - Result 3: the population continued to decline as before in both the experimental condition and the control condition.
   - Result 4: the population stabilized in both the experimental and control conditions.

   Point out that outside or "confounding" variables might produce evidence that makes a hypothesis appear invalid. One example of a confounding variable is an unusual weather event at both the control and experimental sites, such as a severe drought. Another is an unintended consequence of an action, such as when increased food supplies attract so many predators that the animal that land managers want to protect continues to be threatened. Ask students why these confounding variables do not make an experiment a failure.

Assessment

The students' experiments should demonstrate their understanding of elements such as hypothesis, independent and dependent variables, control condition, and measurement.

Ask students to design an experiment for a habitat in the schoolyard or a nearby area, including observation, hypothesis development, variable identification, data collection, and conclusion.

Adaptations to Consider

Give a writing assignment in which students reframe a decision they need to make as an experiment. For example, have them describe how they would develop an experiment if they wanted to convince their parents to allow them to join a sports team or other activity despite concerns that their grades would suffer.

Instead of having groups present their designs to the entire class, ask two or three students from each group to join two or three students from another group to critique each other's designs.

Show the video from the Sage-Grouse Initiative (*https://www.youtube.com/watch?v=zNP8jl2nvrg*), and ask students to (1) identify which monitoring techniques are shown, (2) describe the conservation strategies, and (3) explain the extent to which efforts in the video are supported by experimental evidence (i.e., are there hypotheses, independent and dependent variables, controls, and data collection and analysis?).

In the Field

Ask students to conduct the kind of experiment outlined in the activity based on a habitat and an animal in the area near your school.

Experiment Design Worksheet

Background

You have learned through the Internet investigation and other activities that the survival of your animal is threatened as its population declines. In every case, threats to the habitat are the key reason the animal is at risk. Land management agencies such as the BLM have a number of options when trying to improve habitat and stabilize the population of threatened animals.

How should land managers choose one action over the others? One of the best ways for them to choose an action is to conduct a scientific experiment. In this activity, you and your group will design an experiment that might help land managers choose among options to stabilize the animal's population.

Task

The BLM and its partners want you to advise them about how they should conduct an experiment to test the effectiveness of an action that will improve habitat, with a goal of reversing the decline of your animal's population. Refer to your Internet investigation slide show for ideas about the choices. Here are the steps to follow to design the experiment:

***Step 1:** Develop a hypothesis that land use managers may test with an experiment.* Start by identifying an action you think would improve your animal's habitat.

_____

_____

_____

_____

***Step 2:** Identify the independent and dependent variables and use them to title your experiment.* Titles often follow this phrasing: "The Effect of [one thing] on [another thing]."

The "one thing" is an independent variable. It is the habitat-improving action that you think the land managers should test.

The "another thing" is a dependent variable. It is the effect you think (but do not know) will result from your action. In this case, your dependent variable is the condition of your animal's habitat.

Title: "The Effect of _____ on _____."

Step 3: *Make a prediction.* Use an "if-then" statement to express the result you think your independent variable (action) will have on your dependent variable (habitat). Your prediction should be specific and measurable; for example, "if 50 percent of the invasive tamarisk plants are physically removed from the animal's habitat, then the bulrush plants the animal eats will increase by 25 percent."

Prediction

If _____ (precise independent variable),

then _____ (predicted amount of change in dependent variable).

Step 4: *Define a control condition.* It makes sense to call your experiment "the experimental condition." But you need something to compare that to, such as a condition in which you take no action. In this case, you can assume that "the control condition" is that land managers would take no action instead of the action you proposed. You will want to gather data from an area or plot that is in the control condition—meaning that it is as similar to the experimental plot as possible, with the only difference being that you took no action—so you can compare that data with data gathered from a plot in experimental condition.

Step 5: *Determine the data needed and collect the data.* How will you and the land managers be able to tell whether your action is even beginning to have a positive effect on your animal's habitat? List some things that would indicate habitat improvements (under "indicators"). Then for each item, describe the data you would collect to give you evidence for how well your action worked. Finally, set a timeframe. You may want to base this on the lifespan or breeding cycle of your animal. Your slides from the Internet investigation activity may help you determine some of the data you need to collect.

Indicators	Data Collection	Timeframe

Acknowledgments

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